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# CONTENS

# Multi-UAV Coordination and Control Interface


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## Abstract

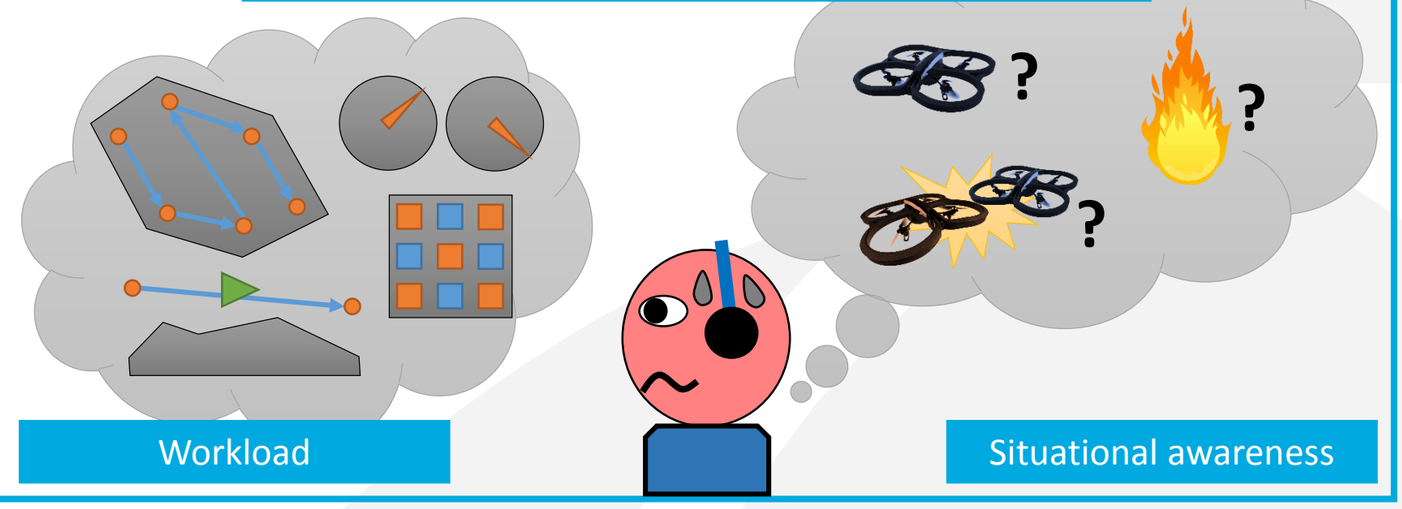

Let's imagine a fire control mission performed by multiple robots and commanded by a single operator. This scenario poses two challenges related to human factors: workload - the operator has to receive data, discover information, make decisions and send commands - and situational awareness - he/she has to know what is happening at any time of the mission. This work aims for the selection of the information that is shown by the interface to the operator. This information should be outlined according to the mission's state and evolution together with the operator class, state and preferences. The expected result is an intelligent adaptive interface that provides the most relevant information for each task.


## Chapter 1: A game of drones

Multi-robot missions generate a huge amount of data.

Motor, Speed, Actuator, Current, Longitude, Command, Waypoint, Humidity, Telemetry, Fuel, Voltage, Target, Distance, Payload, Camera, Mode, Temperature, Roll, Acceleration, Yaw, Orientation, Pitch, Resource, Latitude, Battery, Altitude, Position, Robot, Sensor, Tank

This fact may cause human factor problems...




## Chapter 2: Deconstructing mission

**Data**

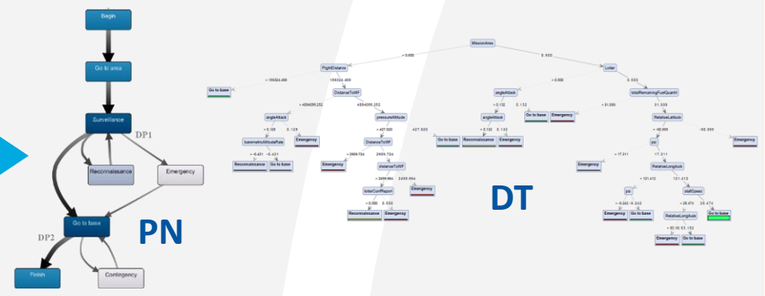
Motor, Speed, Actuator, Current, Longitude, Command, Waypoint, Humidity, Telemetry, Fuel, Voltage, Target, Distance, Payload, Camera, Mode, Temperature, Roll, Acceleration, Yaw, Orientation, Pitch, Resource, Latitude, Battery, Altitude, Position, Robot, Sensor, Tank

**1** The data from previous missions is collected by event logs.

| Case | Activity | Time | Resource |
|---|---|---|---|
| M1 | Surveillance | 1:10 | UAV 1 |
| M1 | Reconnaissance | 1:13 | UAV 2 |
| M1 | Capture | 1:17 | UAV 1 |

**2** The models are automatically generated from the event logs with process mining.

**3** Petri nets are used to define the mission state and decision trees predict its evolution.




**4** The models are applied to discover relevant information according to the situation.

**Information**

Robot 1:
- Distance to base.

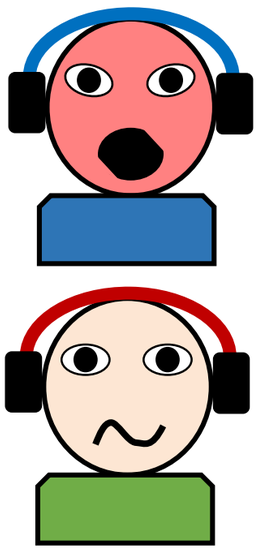
Robot 2:
- Battery.
- Altitude.

Robot 3:
- Camera.

Robot 4:
- Temperature.
- Water tank.

## Chapter 3: There's something about Operator

Now the information is adapted to the mission, but what about the operator?



Data mining allows to discover patterns and classify operators...

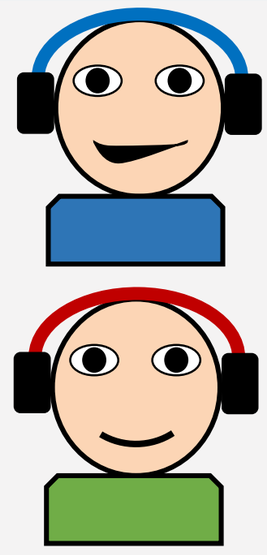
| Operator | #1 |
|---|---|
| Class | Professional |
| Stress | High |

| Operator | #12 |
|---|---|
| Class | Training |
| Stress | Low |

... and machine learning can be used to find their preferences.

- Reduce amount of information.
- Select preferred variables.

- Information useful for training.
- Activate decision support.

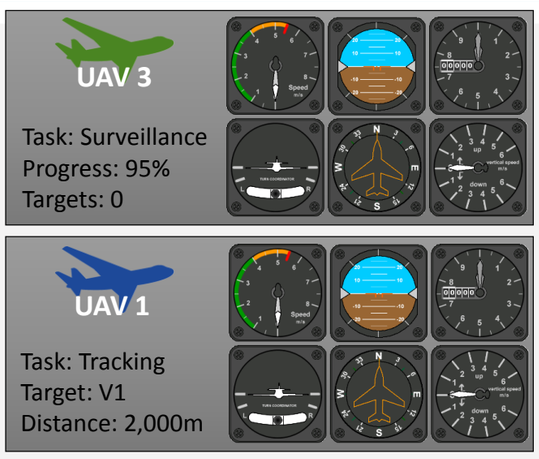


## Chapter 4: The lord of the UAVs

The result is an intelligent adaptive interface that helps the operator.

**Priority**

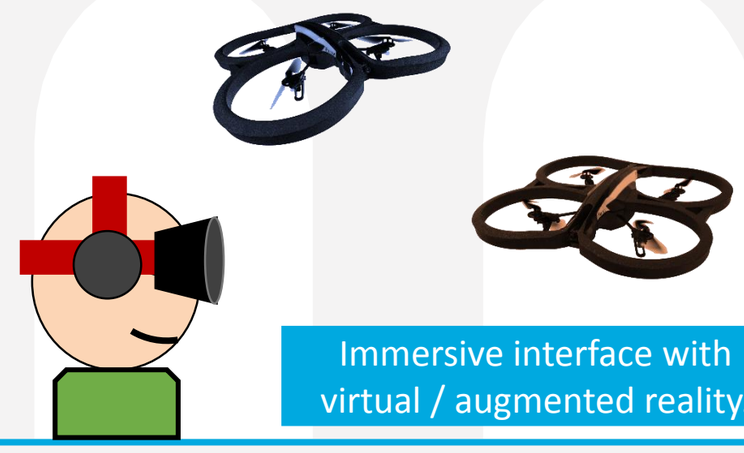





**Events**

- UAV 3 battery is low.
- UAV 1 is finishing surveillance.
- UAV 2 is landing.
- ...

One moment... Why not try something else?



Immersive interface with virtual / augmented reality.